

AMENDMENTS TO THE CLAIMS

Claim 1 (Original) A recycling method comprising:

selectively combusting a carbon component in a material;
pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source; and
supplying a pyrolysate produced in said pyrolyzing and gasifying process to at least one of an oil refinery process and a petrochemical process.

Claim 2 (Original) A recycling method comprising:

selectively combusting a carbon component in a material;
pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source;
cooling and cleaning a pyrolysate produced in said pyrolyzing and gasifying process; and
supplying the cooled and cleaned pyrolysate to at least one of an oil refinery process and a petrochemical process.

Claim 3 (Currently Amended) The recycling method as recited in claim 1-~~or~~2, wherein said supplying process comprises supplying the pyrolysate to an atmospheric distillation process of the oil refinery process.

Claim 4 (Currently Amended) The recycling method as recited in claim 1-~~or~~2, wherein said supplying process comprises supplying the pyrolysate to an ethylene production process of the petrochemical process.

Claim 5 (Original) A recycling method comprising:

selectively combusting a carbon component in a material;
pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source;
separating a pyrolysate produced in said pyrolyzing and gasifying process into fractions; and

supplying the fractions to at least one of an oil refinery process and a petrochemical process.

Claim 6 (Original) A recycling method comprising:

selectively combusting a carbon component in a material;

pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source;

cooling and cleaning a pyrolysate produced in said pyrolyzing and gasifying process;

separating the cooled and cleaned pyrolysate into fractions; and

supplying the fractions to at least one of an oil refinery process and a petrochemical process.

Claim 7 (Currently Amended) The recycling method as recited in claim 5-~~or 6~~, wherein the fractions comprise at least one of gas, naphtha, kerosene, and light oil.

Claim 8 (Currently Amended) The recycling method as recited in ~~any one of claims 5 through 7~~ claim 5, wherein said supplying process comprises supplying the fractions to an atmospheric distillation process of the oil refinery process.

Claim 9 (Currently Amended) The recycling method as recited in ~~any one of claims 5 through 7~~ claim 5, wherein said supplying process comprises supplying the fractions to an ethylene production process of the petrochemical process.

Claim 10 (Original) A recycling method comprising:

selectively combusting a carbon component in a material;

pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source;

cleaning a pyrolysate produced in said pyrolyzing and gasifying process with distillate oil discharged from an atmospheric distillation process of an oil refinery process or oil into which the distillate oil has been refined; and

supplying at least one of the oil used in said cleaning process and the cleaned pyrolysate to at least one of the atmospheric distillation process of the oil refinery process and a petrochemical process.

Claim 11 (Currently Amended) The recycling method as recited in ~~any one of claims 1 through 10~~ claim 1, wherein the material includes residual oil discharged from the oil refinery process or the petrochemical process.

Claim 12 (Original) The recycling method as recited in claim 11, wherein the residual oil comprises residual hydrocarbon heavy oil discharged from an atmospheric distillation process of the oil refinery process.

Claim 13 (Original) The recycling method as recited in claim 11, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an atmospheric distillation process of the oil refinery process and flashed under a reduced pressure.

Claim 14 (Original) The recycling method as recited in claim 11, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an atmospheric distillation process or a vacuum distillation process of the oil refinery process and pyrolyzed.

Claim 15 (Original) The recycling method as recited in claim 11, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an ethylene production process of the petrochemical process.

Claim 16 (Original) The recycling method as recited in claim 15, wherein the residual oil comprises pyrolyzed tar.

Claim 17 (Currently Amended) The recycling method as recited in ~~any one of claims 1 through 10~~ claim 1, wherein the material includes waste.

Claim 18 (Original) The recycling method as recited in claim 17, wherein the waste comprises at least one of waste plastic and shredder dust.

Claim 19 (Currently Amended) The recycling method as recited in ~~any one of claims 1 through 10~~ claim 1, wherein the material includes organic matter.

Claim 20 (Original) The recycling method as recited in claim 19, wherein the organic matter comprises biomass.

Claim 21 (Currently Amended) The recycling method as recited in ~~any one of claims 1 through 20~~ claim 1, further comprising using at least one of hydrogen gas, methane gas, ethylene gas, ethane gas, propylene gas, propane gas, and steam as a gasifying agent for said pyrolyzing and gasifying process.

Claim 22 (Currently Amended) The recycling method as recited in ~~any one of claims 1 through 20~~ claim 1, further comprising using gas recovered in the oil refinery process as a gasifying agent for said pyrolyzing and gasifying process.

Claim 23 (Currently Amended) The recycling method as recited in ~~any one of claims 1 through 20~~ claim 1, further comprising using particles containing metal as a heating medium for said pyrolyzing and gasifying process.

Claim 24 (Original) The recycling method as recited in claim 23, wherein the metal comprises iron, cobalt, or ruthenium.

Claim 25 (Currently Amended) The recycling method as recited in ~~any one of claims 1 through 20~~ claim 1, further comprising using a substance having a desulfurization function as a heating medium for said pyrolyzing and gasifying process.

Claim 26 (Original) The recycling method as recited in claim 25, wherein the substance comprises calcium oxide, calcium carbonate, or calcium hydroxide.

Claim 27 (Currently Amended) The recycling method as recited in ~~any one of claims 1 through 26~~ claim 1, wherein said pyrolyzing and gasifying process is performed by a pyrolysis apparatus having a combustion chamber for selectively combusting the carbon component and a gasification chamber for pyrolyzing and gasifying the material by using heat of combustion in the combustion chamber as a heat source.

Claim 28 (Original) The recycling method as recited in claim 27, wherein the pyrolysis apparatus comprises an internal circulating fluidized-bed gasification furnace.

Claim 29 (Currently Amended) The recycling method as recited in claim 27 ~~or 28~~, further comprising supplying the material to both of the combustion chamber and the gasifying chamber of the pyrolysis apparatus.

Claim 30 (Original) A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source; and

a passage for supplying a pyrolysate produced in said gasification section to at least one of an oil refinery system and a petrochemical system.

Claim 31 (Original) A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source;

an oil scrubber disposed downstream of said gasification section for cooling and cleaning a pyrolysate produced in said gasification section; and

a passage for supplying the cooled and cleaned pyrolysate to at least one of an oil refinery system and a petrochemical system.

Claim 32 (Currently Amended) The recycling system as recited in claim 30-~~or 31~~, wherein said passage is configured to supply the pyrolysate to an atmospheric distillation unit of the oil refinery system.

Claim 33 (Currently Amended) The recycling system as recited in claim 30-~~or 31~~, wherein said passage is configured to supply the pyrolysate to an ethylene production system of the petrochemical system.

Claim 34 (Original) A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source;

a fractionating tower disposed downstream of said gasification section for separating a pyrolysate produced in said gasification section into fractions; and

a passage for supplying the fractions to at least one of an oil refinery system and a petrochemical system.

Claim 35 (Original) A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source;

an oil scrubber disposed downstream of said gasification section for cooling and cleaning a pyrolysate produced in said gasification section;

a fractionating tower disposed downstream of said gasification section for separating the cooled and cleaned pyrolysate into fractions; and

a passage for supplying the fractions to at least one of an oil refinery system and a petrochemical system.

Claim 36 (Currently Amended) The recycling system as recited in claim 34 or 35, wherein the fractions comprise at least one of gas, naphtha, kerosene, and light oil.

Claim 37 (Currently Amended) The recycling system as recited in ~~any one of claims 34 through 36~~ claim 34, wherein said passage is configured to supply the fractions to an atmospheric distillation unit of the oil refinery system.

Claim 38 (Currently Amended) The recycling system as recited in ~~any one of claims 34 through 36~~ claim 34, wherein said passage is configured to supply the fractions to an ethylene production system of the petrochemical system.

Claim 39 (Original) A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source;

a cleaning unit for cleaning a pyrolysate produced in said gasification section with distillate oil discharged from an atmospheric distillation unit of an oil refinery system or oil into which the distillate oil has been refined; and

a passage for supplying at least one of the oil used in said cleaning unit and the cleaned pyrolysate to at least one of the atmospheric distillation unit of the oil refinery system and a petrochemical system.

Claim 40 (Currently Amended) The recycling system as recited in ~~any one of claims 30 through 39~~ claim 30, wherein the material includes residual oil discharged from the oil refinery system or the petrochemical system.

Claim 41 (Original) The recycling system as recited in claim 40, wherein the residual oil comprises residual hydrocarbon heavy oil discharged from an atmospheric distillation unit of the oil refinery system.

Claim 42 (Original) The recycling system as recited in claim 40, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an atmospheric distillation unit of the oil refinery system and flashed under a reduced pressure.

Claim 43 (Original) The recycling system as recited in claim 40, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an atmospheric distillation unit or a vacuum distillation unit of the oil refinery system and pyrolyzed.

Claim 44 (Original) The recycling system as recited in claim 40, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an ethylene production system of the petrochemical system.

Claim 45 (Original) The recycling system as recited in claim 44, wherein the residual oil comprises pyrolyzed tar.

Claim 46 (Currently Amended) The recycling system as recited in ~~any one of claims 30 through 39~~ claim 30, wherein the material includes waste.

Claim 47 (Original) The recycling system as recited in claim 46, wherein the waste comprises at least one of waste plastic and shredder dust.

Claim 48 (Currently Amended) The recycling system as recited in ~~any one of claims 30 through 39~~ claim 30, wherein the material includes organic matter.

Claim 49 (Original) The recycling system as recited in claim 48, wherein the organic matter comprises biomass.

Claim 50 (Currently Amended) The recycling system as recited in ~~any one of claims 30 through 49~~ claim 30, wherein at least one of hydrogen gas, methane gas, ethylene gas, ethane

gas, propylene gas, propane gas, and steam is used as a gasifying agent in said gasification section.

Claim 51 (Currently Amended) The recycling system as recited in ~~any one of claims 30 through 49~~ claim 30, wherein gas recovered in the oil refinery system is used as a gasifying agent in said gasification section.

Claim 52 (Currently Amended) The recycling system as recited in ~~any one of claims 30 through 49~~ claim 30, wherein particles containing metal are used as a heating medium in said gasification section.

Claim 53 (Original) The recycling system as recited in claim 52, wherein the metal comprises iron, cobalt, or ruthenium.

Claim 54 (Currently Amended) The recycling system as recited in ~~any one of claims 30 through 49~~ claim 30, wherein a substance having a desulfurization function is used as a heating medium in said gasification section.

Claim 55 (Original) The recycling system as recited in claim 54, wherein the substance comprises calcium oxide, calcium carbonate, or calcium hydroxide.

Claim 56 (Currently Amended) The recycling system as recited in ~~any one of claims 30 through 55~~ claim 30, wherein said pyrolysis apparatus comprises a combustion chamber for selectively combusting the carbon component and a gasification chamber for pyrolyzing and gasifying the material by using heat of combustion in said combustion chamber as a heat source.

Claim 57 (Original) The recycling system as recited in claim 56, wherein said pyrolysis apparatus comprises an internal circulating fluidized-bed gasification furnace.

Claim 58 (Currently Amended) The recycling system as recited in ~~any one of claims 30 through 57~~ claim 30, further comprising a passage for supplying the material to both of said combustion section and said gasifying section of said pyrolysis apparatus.